ANDREAS VESALIUS (1514 – 1564) - THE FOUNDER OF MODERN HUMAN ANATOMY

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ABSTRACT

Andreas Vesalius was a Belgian physician and anatomist, whose work revolutionised anatomy and contributed to enhancement of knowledge how the human body functioned. Vesalius was born in Brussels in 1514. He studied medicine and anatomy in Paris (1533-1536). He obtained a post of lecturer at the University of Padua and remained there as professor (1537-1542). His important innovations were to perform postmortem dissections and to make use of illustrations in the teaching of anatomy. In 1543 Vesalius published his revolutionary book De humani corporis fabrica (on the structure of the human body). Vesalius helped establish surgery as a separate medical profession. Scientific findings of Vesalius are in field of: skeletal system, muscular system, vascular and circulatory systems, nervous system, abdominal organs, heart, brain. Andreas Vesalius, died June 1564, island of Zacynthus (now in Greece).

Key words: *Andreas Vesalius, anatomy, scientific findings, De humani corporis fabrica*

INTRODUCTION

Andreas Vesalius was a Belgian physician and anatomist and author of one of the most influential book on human anatomy De humani corporis fabrica (On the structure of the human body), 1543 (Fig. 1). In this epochal work, Vesalius deployed all his scientific, humanistic, and aesthetic gifts. The Fabrica was a more extensive and accurate description of the human body than any put forward by his predecessors. Vesalius worked closely with the famous artists who produced anatomical illustrations for his book. He pioneered the use of highly illustrated medical text, where the drawings showed the human body in greater detail then ever before (2,3,4).

Andreas Vesalius was born in Brussels in 1514. His family for several generations dealing with medicine - his great grandfather, received his medical degree from the University of Pavia and taught medicine at the University of Leuven. His grandfather was the Royal Physician of Emperor Maximilian. His father,

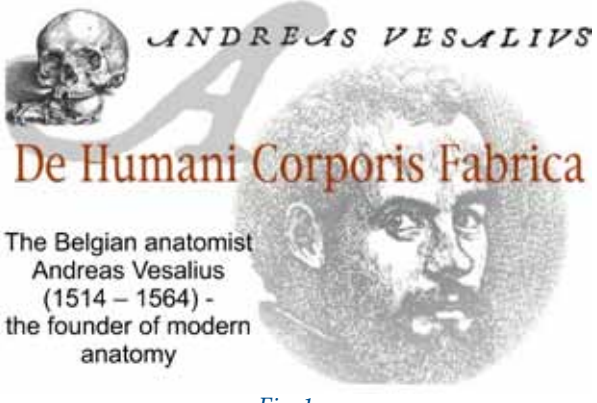

Fig. 1.

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Anders went on to serve as apothecary to Maximillian, and later a "valet de chamber" to Charles V. Vesalius continues the family tradition. In 1528 Vesalius entered the University of Leuven taking arts, but in 1533 Vesalius decided to pursue a career in medicine at the University of Paris (1533 to1536). In 1536 Vesalius was forced to leave Paris due to the opening of hostilities between the Holy Roman Empire and France and he went to the University of Padua to complete his studies. The University of Padua was progressive university with a strong tradition of anatomical dissection. In 1537 he received his doctorate and awarded his medical degree (4).

On graduation Vesalius was immediately offered the chair of Surgery and Anatomy (explicator chirurgiae) at Padua with the responsibility of giving anatomical demonstrations (1537-1542). He also guest lectured at Bologna and Pisa. Vesalius, the first great teacher of anatomy from natural observations, conducted many anatomical demonstrations on human bodies. First to break with Galen's anatomical texts, Vesalius published Tabulae Anatomicae Sex in 1538 (4,7).

In 1539 a Paduan judge became interested in Vesalius' work, and made bodies of executed criminals available for dissection.

In 1541, in Bologna, Vesalius uncovered the fact that all of Galen's research had been based upon animal anatomy rather than the human. At that time, dissection on the human body was illegal and penalties could often be severe. Vesalius, performed a number of postmortem dissections and demonstrated that the anatomical teachings of Galen was based on fundamental anatomical errors. Vesalius noted that the heart had four chambers, the liver two lobes, and that the blood vessels originated in the heart (contrary to other scientists).

Vesalius conducted a public dissection of the body of a notorious criminal from the city of Basel, Switzerland in 1543. He assembled the bones and finally donated the skeleton to the University of Basel. This preparation „The Basel Skeleton" is still displayed at the Anatomical Museum of the University of Basel (Fig. 2).

In 1543, Vesalius published his revolutionary book De humani corporis fabrica (On the structure of the human body) - seven volumes in total on the

Fig. 2. "The Basel Skeleton" - Anatomical Museum of the University of Basel

structure of the human body (Fig. 3). It contained over 200 anatomical illustrations. All were illustrated in detail by artists using Vesalius's own drawings. Never before had illustrations of this quality been seen in a medical book. It was the most detailed anatomical text ever to have been produced. Vesalius was 30 years old when the first edition of Fabrica was published. Vesalius' Fabrica is astonishing in its scale and scope. The woodcut illustrations, attributed to Titian's pupil Jan Kalcar, place the human figures in classical poses and landscapes while the display of the structures are based on Vesalius' direct observations during five years of dissection at Padua. Its contemporary impact was enormous.

Vesalius's bravery and intelligence, however, gained worst enemies among many conservative physicians and Catholic clergy. He was accused of murder in 1564 for the dissection of a Spanish noble who, his disputants said, was still alive. Vesalius was also accused of atheism. King Philip II, however, reduced his sentence to a pilgrimage of penitence to the Holy Land. In 1564 Vesalius leave Spain to go on

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Fig. 3. Cover of Vesalius's book De humani corporis fabrica fabrica (On the structure of the human body)

pilgrimage to the Holy Land. Regrettably, Vesalius on his way back was badly harmed by a storm and he was thrown on the island of Zakynthos. Vesalius was rescued from the sea, but he died shortly thereafter in 1564. At the time of his death he was fifty years of age (4,5).

SCIENTIFIC FINDINGS

Skeletal system

According to Vesalius the skeletal system is the framework of the human body (7).

- He made the first good description of the sphenoid bone (Fig. 4)
- Vesalius showed that the sternum consists of three portions and the sacrum of five or six.
- He described in details the vestibule in the interior of the temporal bone of the skull.

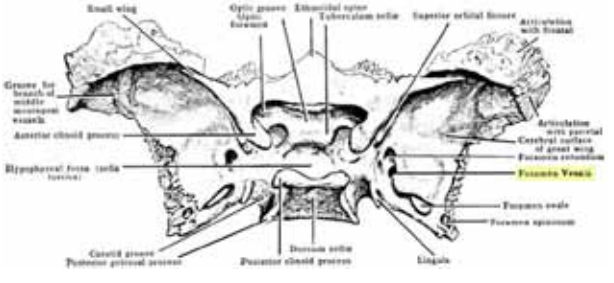

Fig. 4. First described by Andreas Vesalius, this rare foramen in the sphenoid bone transmits a vein (vein of Vesalius) from the cavernous sinus to the pterygoid plexus

- Vesalius claimed that the mandible consisted of one bone, whereas Galen had thought it was two separate bones.
- He noted that bones of the leg (fibula and tibia) were indeed larger than the bone of the arm (humerus), unlike Galen's original findings (Fig. 5).

Fig. 5. Illustration is one of the most famous Vesalian poses of the whole skeleton in contemplative pose, and a memento mori

Muscular system

Vesalius describes the source and position of each muscle of the body as well as providing information on their respective operations. The most impressive contribution to the study of the muscular system may be the illustrations that accompany the text in De fabrica, which would become known as the „muscle men" (7).

Fig. 6. Illustration of the muscular system, commonly referred to as "muscle-men", which present progressively deeper dissections (from behind)

Vascular and circulatory systems

- Vesalius' work on the vascular and circulatory systems was his greatest contribution to the complex and modern medicine (Fig. 7). In the dissection on the heart Vesalius claimed that the interventricular septum was indeed waterproof and he discovered and named the mitral valve to explain the blood flow (7).
- Vesalius believed that the cardiac systole is synchronous with the arterial pulse.
- He described the vein azygos, and discovered the canal which passes into the fetus between the umbilical vein and vena cava.

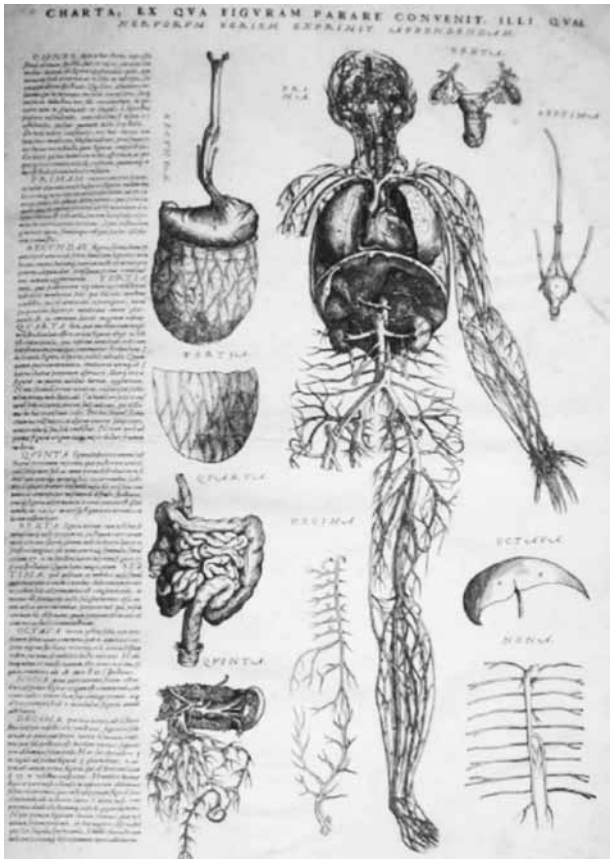

Fig. 7. Illustrations from De humani corporis fabrica (book III) which describes the vascular system

Nervous system

- Vesalius described the nerves as a mode of transmission of sensation and motion. He believed that nerves do not originate from the heart, as was the Aristotelian belief, but that nerves stemmed from the brain.

Abdominal organs

- Vesalius disproved Galen's belief that the liver consisted of five lobes, and stated that is, instead, two lobes.
- According to Vesalius the kidneys serve to filter blood as well and that the excrement then traveled through the ureters to the bladder.
- He described the omentum, and its connections with the stomach, the spleen and the colon and gave the first correct views of the structure of the pylorus.
- He observed the small size of the caecal appendix in man.

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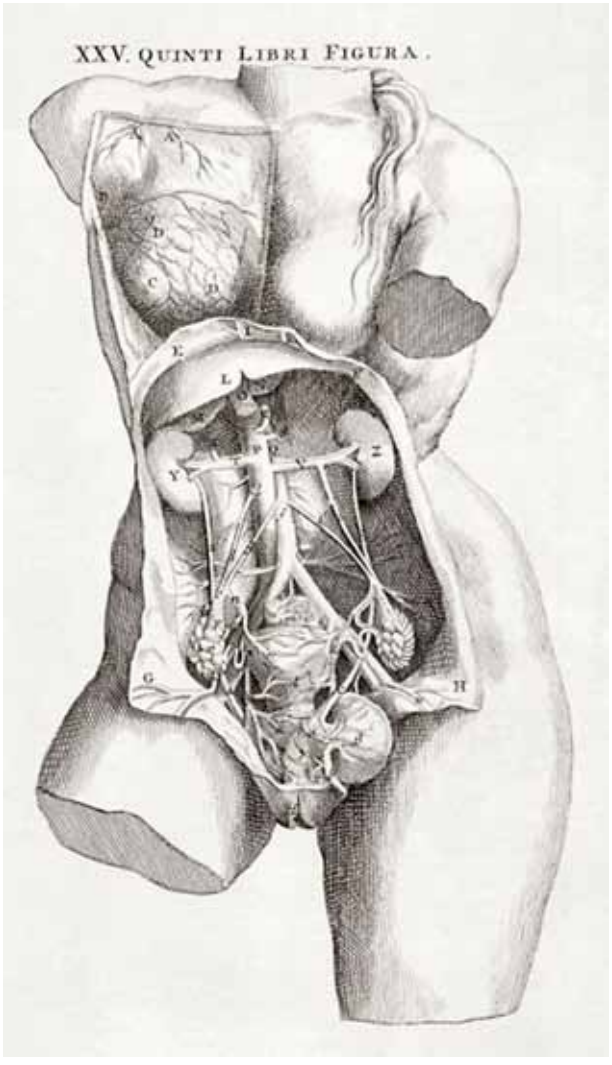

Fig. 8. De humani corporis fabrica - illustrations of the abdominal organs

- He did find that the uterus had been falsely identified as having two distinct sections (7) (Fig. 8).

Heart

- Vesalius identified two chambers and two atria. The right atrium was considered a continuation of the inferior and superior venae cavae and the left atrium was considered a continuation of the pulmonary vein (Fig. 9).

Brain

- Vesalius believed that the brain and the nervous system are center of the mind and emotion in contrast to the common Aristotelian belief that the heart was the center of the body. For the first time Vesalius described the corpus callosum, the thalamus, the caudate nucleus, the lenticular nucleus, the globus pallidus, the putamen, the pulvinar, and the cerebral peduncles and this is the most significant contribution to the study of the brain (Fig. 10).

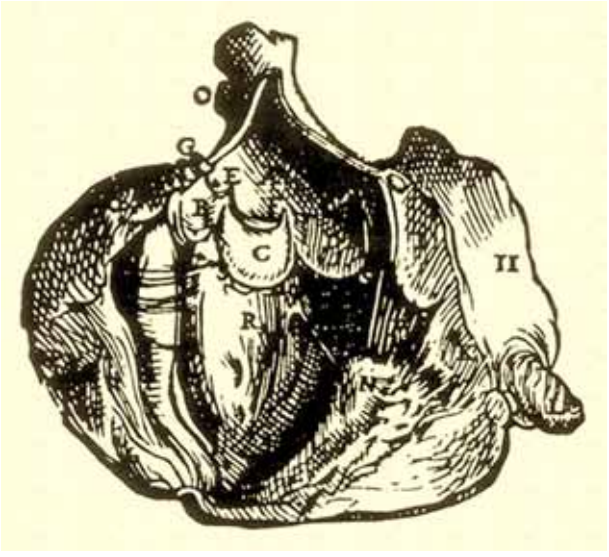

Fig. 9. De humani corporis fabrica - detailed drawing of the human heart

Publications

In 1538, Vesalius wrote Epistola, "docens venam axillarem dextri cubiti in dolore laterali secandam". With this novel approach to the problem of venesection, Vesalius posed the then striking hypothesis that anatomical dissection might be used to test speculation.

In 1543 Vesalius published his revolutionary book De humani corporis fabrica (On the Structure of the Human Body). Vesalius's Fabrica contained many intricately detailed drawings of human dissections, often in allegorical poses. He pioneered the use of highly illustrated medical text, where the drawings showed the human body in greater details than ever before (4,7).

In 1544, Vesalius published an abridged edition for students, entitled De humani corporis fabrica librorum epitome (more commonly known as Epitome), with a stronger focus on illustrations than text, so as to help readers easily understand his findings.

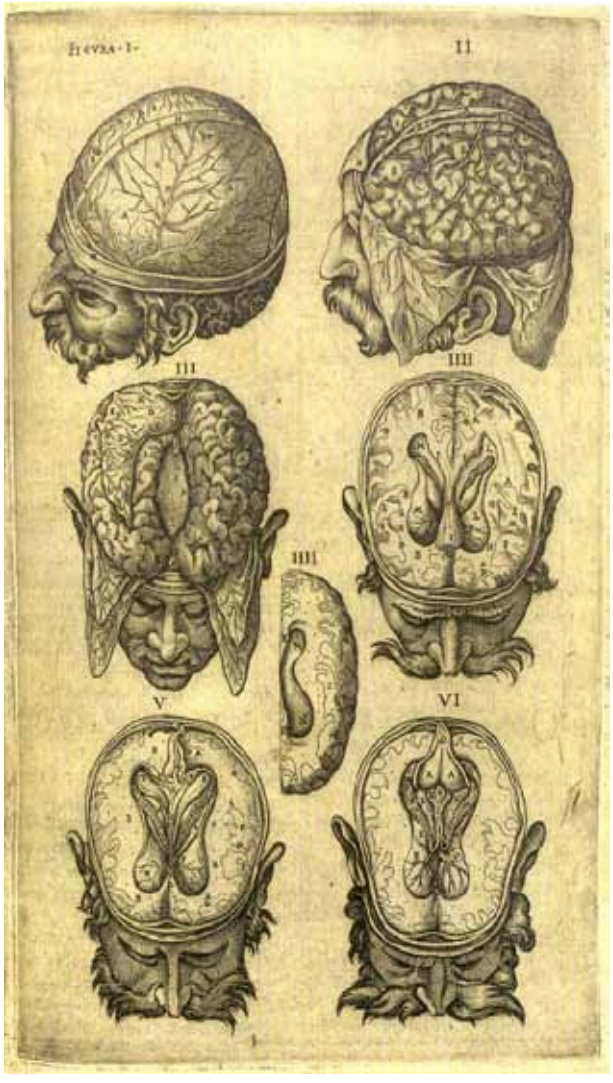

Fig. 10. Andreas Vesalius – dissection of the brain

In 1555 Vesalius published a revised edition of De humani corporis fabrica. The volume was far more elegant than the earlier edition (1).

CONCLUSION

Andreas Vesalius of Brussels has been called "the first man of modern science." (Fig. 11). Vesalius by performing dissections on humans revealed anatomical structures previously unknown. Vesalius's work brought about an important change in medical thinking (4,5,6).

Vesalius published his influential book about human anatomy De humani corporis fabrica. The work was the earliest known precise presentation of human anatomy. The Fabrica, rapidly became

Fig. 11. „Hall of Medicine" – Vesalius (from Doris Appel, the sculptor and medical historian in its original form in her studio in Lynn, Massachusetts)

a classic text in medical education. The book laid down a solid understanding of human anatomy as the groundwork for all medical practice and curing. Vesalius helped establish surgery as a separate medical profession.

Vesalius was the first physician to break openly with tradition, to study anatomy and to write of it directly from observation. Through his attention to detail, he was able to provide clear descriptions and unprecedented anatomical drawings that set a new standard for future medical books.

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